Interaction Models, Agent Knowledge Models, Scenarios, and Agent Behaviour Models for Design

Msury Mahunnah
Department of Informatics
Tallinn University of Technology
The purpose of the course

- To design by AOM a **software-intensive intelligent social product** that delivers the overall solution for the end user through interactions between different nodes and by following the execution loop of an abstract agent.
Logistics

- Lectures on **Wednesdays at 10.00-11.30** in the **main building of TUT, lecture hall VI-229**

- Workshops/lab classes on **Wednesdays at 12.00-13.30** in the **ICT building of TUT at Raja 15, computer class IT-111**, and, if needed, also **IT-109**

- Consultation times by Msury Mahunnah: on **Tuesdays at 14.00 – 15.00** in the **ICT building of TUT at Raja 15, room IT-117**
Communication

- Course webpage: [http://maurus.ttu.ee/sts/?page_id=1242](http://maurus.ttu.ee/sts/?page_id=1242)
- Course mailing list: aine.aom@lists.ttu.ee
- Joining the mailing list: [http://lists.ttu.ee/mailman/listinfo/aine.aom](http://lists.ttu.ee/mailman/listinfo/aine.aom)
Miniproject

- Design and prototyping or simulation of a software-intensive social product

Range of topics:
- Crowdsourcing applications
- Intelligent digital assistants
- Social applications

Two Mektory (http://www.ttu.ee/mektory) projects:
- Healthminer
- Phoenix
Last time

- Domain Model
- Agent Model
- Acquaintance Model
## The Viewpoint Framework

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<tr>
<th>Viewpoint aspect</th>
<th>Abstraction layer</th>
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Domain model

- Domain model represents the knowledge within the system that the system is supposed to handle

- A domain model consists of domain entities and relationships between them as well as with the roles.
What is domain entity?

- A modular *unit of knowledge* handled by a sociotechnical system
- Examples
Domain model for personal medical assistant

- **HEALTHY LIFESTYLES**
- **GENETIC DEFECTS**
- **VERIFIED MEASUREMENTS**
- **DISEASES**
- **ALERT MESSAGES**

- **Physician**
  - Recommends
  - Analyses
  - Provides

- **Family Member**
  - Informs

- **Patient**
  - Receives
  - Analyses
  - Generates

- **Monitor**
  - Sends

- **MEDICAL HISTORY**
  - Provides

- **GENETIC DEFECTS**
  - Identifies

- **HEALTHY LIFESTYLES**
  - Receives

- **VERIFIED MEASUREMENTS**
  - Sends

- **DISEASES**
  - Generates
Domain model for tourist advisor

Tourist Advisor

Provides

Checks

Generates

Identifies

Points out

Based on

Is a kind of

LOCATION

SIGHTSEEING SPOT

TOURIST PROFILE

DIRECTIONS

Advisor

Generates

Determines

Points out

Based on
Software, hardware, humans?

- We now need to decide the *software system boundary* of the socio-technical system
Agent

Agent is an entity that perceives and affects its environment and performs reasoning

Agent is:
- reactive;
- proactive;
- social.

Agent interacts in an asynchronous way
The abstract agent architecture
The execution loop of an abstract agent

while the agent is unfulfilled do
    sense the environment;
    update the knowledge base;
    reason;
    choose actions;
    act;
end while
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Agent model

- The purpose of agent models is to transform the abstract constructs from the analysis stage – roles – to design constructs – agent types – that will be realized at runtime.

- Many-to-many relationship between roles and agent types.
## Agent model for Patient

<table>
<thead>
<tr>
<th>Agent type name</th>
<th>Patient Intelligent Assistant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>The Intelligent Digital Assistant for the patient</td>
</tr>
<tr>
<td><strong>Role(s)</strong></td>
<td>Patient</td>
</tr>
<tr>
<td><strong>Environmental considerations</strong></td>
<td>Medical history, Healthy lifestyles, Verified Measurements, Alert Messages,</td>
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The acquaintance model complements the agent model by outlining interaction pathways between the agents of the system.
Combined agent mapping and acquaintance model for the individualized healthcare system
Today

- Interaction Models
- Agent Knowledge Models
- Scenarios
- Agent Behaviour Models
# The Viewpoint Framework

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Interaction model

- Represents an interaction pattern between agents
- Is based on responsibilities defined for the corresponding roles
Two kinds of interaction models

- Pure interaction models
- Protocol models
Interaction-sequence diagram

1. Person
   - You need to take a test now
   - Thank you for reminder
   - Choose the test you want
   - OK

2. Monitor Agent
   - I have the measurements
   - Please, send me now
   - Sending the measurements

3. Patient Agent
   - Can you verify my Measurements now?
   - Yes, send now
   - Sending the measurements
   - Measurements are OK
   - Thank you

4. Physician Agent
Interaction-frame diagram

Person

- You need to take a test now
- Remind me later
- Thank you for reminder
- Choose the test you want
- OK

Monitor Agent

- I have the measurements
- Sending the measurements
- Please, send me now

Patient Agent

- Can you verify my Measurements now?
- No, send me later
- No, send to another physician
- Yes, send now
- Sending the measurements
- The values are out-of-range
- The readings are out-of-date
- Please re-do the test
- Measurements are OK
- Thank you

Physician Agent
Protocol model

Interaction Protocol

Person

Monitor Agent

Patient Agent

Physician Agent

You need to take a test now

Remind me later

Thank you for reminder

Choose the test you want

OK

I have the measurements

Please, send me now

Sending the measurements

Can you verify the measurements?

Alternative

No, send to another physician

No, send later

Yes, send now

Sending the measurements

Alternative

The values are out-of-range

The readings are out-of-date

Please, re-do the test

Measurements are OK

Thank you
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Knowledge model

- Elaboration of the domain model
- Represents the knowledge that agents have about their environments and about themselves
- Can be viewed as an ontology providing a framework of knowledge for the agents of the problem domain
Two categories of knowledge items

- Knowledge attributes
- Conceptual objects
Knowledge attributes of a Patient

<table>
<thead>
<tr>
<th>Knowledge attribute</th>
<th>Type</th>
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</thead>
<tbody>
<tr>
<td>Name</td>
<td>String</td>
</tr>
<tr>
<td>Gender</td>
<td>Enumeration (male;female)</td>
</tr>
<tr>
<td>Date of Birth</td>
<td>Date</td>
</tr>
<tr>
<td>Blood Group</td>
<td>Enumeration (A; B; AB; O)</td>
</tr>
<tr>
<td>Weight</td>
<td>Real</td>
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A partial knowledge model for a Personal Medical Assistant
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<td>interaction</td>
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Scenario

- Elaborates a motivational scenario
- A collective activity that models how particular goal is achieved by agents enacting particular roles
- May contain sub-scenarios
A scenario for achieving the goal “Deliver health care”

<table>
<thead>
<tr>
<th>SCENARIO 1</th>
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<tbody>
<tr>
<td><strong>Goal</strong></td>
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<tr>
<td><strong>Initiator</strong></td>
</tr>
<tr>
<td><strong>Trigger</strong></td>
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</table>

**DESCRIPTION**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Step</th>
<th>Activity</th>
<th>Agent types and roles</th>
<th>Resources</th>
<th>Quality goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequential</td>
<td>1</td>
<td>Diagnose possible disease</td>
<td>Person/Patient, Patient Agent/Patient, Physician Agent/Physician, Geneticist Agent/Geneticist</td>
<td>Symptoms, Genetic data, Genetic defects</td>
<td>Personalised</td>
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<td>(Scenario 2)</td>
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<tr>
<td></td>
<td>2</td>
<td>Suggest disease</td>
<td>Patient Agent/Patient, Physician Agent/Physician</td>
<td></td>
<td>Disease</td>
</tr>
<tr>
<td>Interleaved</td>
<td>3</td>
<td>Prescribe medicine</td>
<td>Patient Agent/Patient, Physician Agent/Physician</td>
<td></td>
<td>Prescription, Personalised, Precise</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Monitor health condition</td>
<td>Person/Patient, Patient Agent/Patient, Physician Agent/Physician, Monitor Agent/Monitor</td>
<td>Alert, Measurements</td>
<td>Personalised</td>
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<td>(Scenario 3)</td>
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A scenario for achieving the goal “Monitor health condition”

<table>
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<th>SCENARIO 3</th>
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<td><strong>Goal</strong></td>
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<td><strong>Initiator</strong></td>
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<tr>
<td><strong>Condition</strong></td>
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<tr>
<td>Loop</td>
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<tr>
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Behaviour models

- A scenario focuses on how a multiagent system achieves the goals set for it

- A behaviour model addresses what an individual agent does
Two kinds of behaviour models

- Behavioral interface models
- Agent behaviour models
A behavioral interfaces for “Obtain readings” and “Verify readings” activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Trigger</th>
<th>Pre-conditions</th>
<th>Post-conditions</th>
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</table>
| Obtain readings   | Reminder sent to the Patient by the Monitor Agent | • Monitoring schedule has been set  
• The condition to be monitored has been chosen | • Measurements for the health condition                  |
| Verify readings   | Measurements received by the Physician Agent      | • Patient Agent has measurements                                             | • Out-of-date readings  
• Out-of-range readings  
• Need to re-do the test  
• Validated readings |
Agent behaviour model 1
Agent behaviour model 2

- R1 – Verifies the received CLRs
- R2 – Checks the availability of the physician
- R3 – Identifies the next suitable physician
- R4 – Controls the sending of CLRs
- R5 – Checks notifications from the physician
Today

- Workshop on creating AOM analysis models with Microsoft Visio – 2
MS Visio Stencils for AOM